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Bentgrass Dead Spot: A New Disease Incited by *Ophiosphaerella agrostis*

Peter H. Dernoeden

In late summer of 1998, a new fungal disease of relatively young creeping bentgrass (*Agrostis stolonifera*) putting greens in Maryland, Virginia, Pennsylvania and Ohio was discovered. The causal agent was reported to be an undescribed species of *Ophiosphaerella* (Dernoeden et al., 1999). An isolate obtained from a bentgrass nursery with similar disease symptoms was obtained from Dr. Randy Kane of the University of Illinois. The Illinois isolate also was confirmed to be the same undescribed species of *Ophiosphaerella*. The disease since has been found in Georgia, Massachusetts, Missouri, New Jersey, and North and South Carolina. In 1999, we confirmed the disease in Texas in a "Champion" bermudagrass (*Cynodon dactylon* x *C. transvaalensis*) research green at Texas A&M University. Hence, **the disease has been found in eleven states and has probably gone misdiagnosed in many other areas of the country.**

There are about seven other known species of *Ophiosphaerella,* and three have been reported to be turfgrass pathogens. *Ophiosphaerella herpotricha*, *O. korrae* (syn. *Leptosphaeria korrae*) and *O. narmari* (syn. *L. narmari*) are causal agents of spring dead spot of bermudagrass (*Cynodon* spp.). *Ophiosphaerella herpotricha* also incites spring dead spot of American buffalograss (*Buchlöe dactyloides*), while *O. korrae* is the causal agent of necrotic ring spot in creeping red fescue (*Festuca rubra* var. *rubra*), Kentucky (*Poa pratensis*), and annual (*Poa annua*) bluegrasses. All of the aforementioned *Ophiosphaerella* species are turfgrass root pathogens. A unifying characteristic of these turfgrass pathogens is that they produce darkly pigmented hyphae on roots, but none of these pathogens has been associated with creeping bentgrass (Clarke and Gould, 1993; Wetzel et al., 1996). A study of colony characteristics, spores and fruiting bodies was made from a collection of isolates from eight of the affected clubs. This morphological data and information, when compared to published descriptions, indicated that the new pathogen may be an unknown species of *Ophiosphaerella*. **Through DNA testing, the fungus was shown to be an undescribed species of *Ophiosphaerella*. The pathogen was named *O. agrostis* and the disease will be known as bentgrass dead spot** (Camara et al., 2000).

This new disease of creeping bentgrass first appeared between August and September of 1998 on putting greens in Maryland, Virginia, Pennsylvania and Ohio. According to Dr. Randy Kane, however, the disease was first noted at the Skokie C.C. in Glencoe, Illinois in the autumn of 1997. In 1999, the first known outbreak of bentgrass dead spot was observed in June at Trenton C.C. in New Jersey, and additional confirmations were forthcoming in July, August and into early autumn. The disease is less common on tees and collars, and thus far has not been found on fairways.

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Manor 60DF (metsulfuron) is an Option for Removal of Perennial Ryegrass Overseeded into Bermudagrass

Fred Yelverton

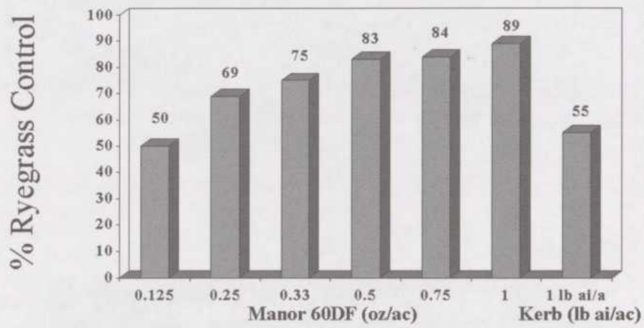
As mentioned in the last issue of TurFax, metsulfuron has returned to the market under a new trade name called Manor®. Manor® 60DF is sold by the Riverdale Company and will provide turfgrass managers with an option to control several troublesome weed species. One of those species may be perennial ryegrass (*Lolium perenne*) overseeded into bermudagrass (*Cynodon* spp.).

Overseeding warm-season turf species is often controversial. However, there is no doubt that winter color is enhanced by overseeding. Once temperatures start to warm in the spring, the overseeded turf must be removed to allow the underlying warm-season species to grow. This "transition" period is often difficult and can result in an undesirable playing surface. In many climates, the overseeded turf may die out on its own. However, the development of more heat- and disease-tolerant perennial ryegrasses has led to difficulty in obtaining a natural transition. In such cases, the use of a herbicide can accelerate the removal of ryegrass and ensure that this species is completely removed in a timely manner. The trick, of course, is to have the perennial ryegrass die out gradually as the warm-season turf begins to grow. This "smooth transition" will lead to acceptable turf quality during this period of time.

This is where Manor® can be of assistance. Previously, many turfgrass managers have relied on pronamide (Kerb® 50WP) to assist in transition. Kerb® applied at approximately 1 lb ai/ac (1.1 kg ai/ha) usually ensures complete kill of the perennial ryegrass without harm to bermudagrass. In addition, Kerb® eliminates the ryegrass very gradually (usually over a 4- to 6-week period) and results in acceptable turf throughout the transition period. **Research also has shown Manor® 60DF can eliminate perennial ryegrass and provide an acceptable transition.**

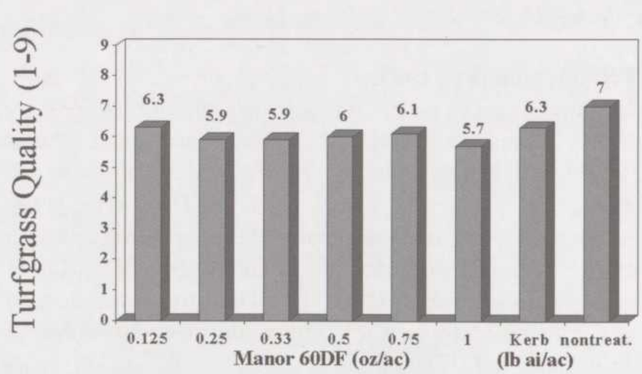
Figure 1 is from a research trial conducted in the spring of 2000 at the Turfgrass Field Laboratory at North Carolina State University on the removal of perennial ryegrass from overseeded bermudagrass. The applications were made on April 10 and the ratings were taken on May 10. As noted in Figure 1, Manor® is gradually providing good control of the perennial ryegrass and turf quality (Figure 2) is acceptable. From this trial, it is questionable whether the lowest rate (0.125 oz/ac or 8.75 g/ha) will provide complete kill of the ryegrass. In fact, the Manor® label suggests 0.33 to 0.5 oz/ac (9.4 to 14.2 g/ha) is needed to kill perennial ryegrass. The results of this research are in agreement with the label directions. Note that most of the **Manor® rates are providing a more rapid kill of perennial ryegrass than Kerb®.** However, also note that turfgrass quality (Figure 2) on a scale of 1 to 9 is not below 5 (the minimum level of acceptable turf quality) with any of the treatments. This indicates a good transition, even though it is slightly faster than Kerb®.

This, and other research, indicates that Manor® can be a useful tool in removing perennial ryegrass from bermudagrass. The kill is slow enough so there is limited browning effect on the turf. The fact that turf quality is acceptable throughout the ryegrass removal process indicates a smooth transition.



Treatments applied April 10; % control ratings taken May 10; research conducted at NCSU Turfgrass Field Lab, Spring 2000

Figure 1. Perennial ryegrass control in overseeded bermudagrass with Manor® 60DF and Kerb® 50WP.



Treatments applied April 10; turf quality ratings taken May 10; research conducted at the NCSU Turfgrass Field Lab, Spring 2000

Figure 2. Turfgrass quality of perennial ryegrass and bermudagrass with Manor® 60DF and Kerb® 50WP during transition.

FEATURE ARTICLE

Invasive Grub Species Still on the Move!

Daniel A. Potter

Early June to mid-July is the optimal period for preventive control of most species of white grubs in the cool-season and transition turfgrass zones. As we prepare for the annual grub onslaught, it's worth noting that several important species are expanding their ranges and causing problems in areas where they may not have been problematic in the past.

Lately I'm getting lots of calls from turf managers in Indiana, Illinois, Michigan, Wisconsin, Iowa, Missouri, and Arkansas about plague-like infestations of Japanese beetles (*Popillia japonica*) they've experienced in the past two years. Japanese beetle (JB), an exotic species that first was discovered near Riverton, New Jersey in 1916, has steadily spread so that it now is established in all states east of the Mississippi River except for Florida. As this pest moves into new counties and states, the pattern has been for it to reach outbreak densities for the first 10 to 15 years or so after establishment, after which population levels slowly decline and equilibrate at levels that are troublesome, but somewhat less overwhelming. Entomologists don't fully understand why this occurs, but likely it has to do with a whole suite of natural enemies, including pathogenic microorganisms (milky disease bacteria, nematodes, and others), parasitic insects, and predators, that lag behind the JB population but eventually "kick in" to suppress the grub stage. That's the pattern we've experienced in Kentucky since the early 1980s.

In the meantime, turf managers dealing with JB may benefit from lessons that we've learned from field research. First, **traps probably won't solve your JB problems; more likely, they'll aggravate them by attracting far more egg-laying and leaf-chomping beetles than actually are caught.** I'm unaware of any evidence that you can "trap out" an infestation once the pest is established. **Milky disease spore powder has performed poorly in field trials,** including multi-year trials on golf courses. Certain trees and shrubs, among them lindens, sassafras, purple-leaf plums, Norway maples, wild and cultivated grapes, and many crabapple varieties, are JB magnets, attracting hordes of hungry adults, which lay eggs in nearby moist turf. **Where practical, substitute resistant plants** (e.g., red maple, ornamental pears, tuliptree, ash, dogwood, etc.). **Carbaryl (Sevin®) has been the industry standard for controlling the adults.** Professionals also can use pyrethroids [e.g., binfentrin (Talstar®), lambda-cyhalothrin (Scimitar®), cyfluthrin (Tempo®)], or other products. Repeat (weekly) applications usually are needed to protect highly favored host plants. **Imidacloprid (Merit®) or halofenozide (Mach 2®) generally provide excellent preventive control of the grubs if applied any time from early June to mid-July.** Thiamethoxam (Meridian®), the new insecticide from Novartis whose registration is expected later this summer, also gives excellent preventive control of JB grubs. **Trichlorfon (Dylox®) is your best bet for "rescue" treatments after the grub damage appears.**

European chafer (EC), *Rhizotrogus majalis,* another highly destructive grub species, also seems to be on the move. The EC is endemic to western and central Europe and was first discovered in the United States near Rochester, New York in 1940. Since then it has spread and become established in New York, Connecticut, Massachusetts, Rhode Island, northern and central Pennsylvania, across northern Ohio into eastern Michigan, and into Ontario, Canada along the Niagara frontier.

Like other annual grub species (e.g., masked chafers and JB), the EC has a one-year life. The night-flying adults are light reddish-brown beetles, resembling May beetles or so-called "Junebugs," about 9/16 in. (13–15 mm) long, with distinct longitudinal grooves on the wing covers. Adults, which are active in June and July, emerge from the turf at dusk on warm, clear nights and fly to trees, where dense mating aggregations occur. The adults nibble the margins of tree leaves but cause little real damage. Eggs are laid in moist turf and generally hatch into grubs by late July or early August. EC grubs resemble other grub species, but can be distinguished by examining the pattern of spines on the raster (an area of spines and hairs on the underside of the tail end). **The EC raster has two distinct, nearly parallel rows of small spines that diverge outward at the tip of the abdomen, like a partly open zipper.** (See *Destructive Turfgrass Insects,* Ann Arbor Press, or check the website

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FEATURE ARTICLE

Mowing Strategies

James B Beard

Mowing is the most basic of the turfgrass cultural practices. The resultant removal of a significant portion of the leaves is by nature a continuing, externally imposed stress on the plant. As the mowing height is lowered within the cutting height range for a given low-growing turfgrass species, the following morphological and physiological responses occur: **decreased leaf blade width, decreased carbohydrate synthesis and storage, decreased root growth rate, decreased total root production, decreased rhizome/stolon growth, and increased shoot density.** An increased mowing frequency of low-growing turfgrasses has similar effects, with the negative impacts being not as great as is the case of lower cutting heights.

The specific cutting height selected for a turfgrass area can strongly affect the general health of the turf and the specific turfgrass species that becomes dominant on a long-term basis. **The primary criteria to be considered in selecting a cutting height for a given area include the (a) specific turfgrass species and cultivar involved, (b) effects on the physiological and morphological conditions of the turfgrass, and (c) purpose for which the turf is to be utilized.** The cutting height selected for certain uses has much greater negative effects than would normally be desirable. An example would be putting and bowling greens, where the requirements of the game far outweigh the major negative effects on turfgrass morphology and physiology. The preferred cutting height range and mowing frequency range suggested for sports fields, golf course fairways, and high-quality lawns are shown in the accompanying table.

The removal of an excessive quantity of green leaf surface area at any one mowing can result in what is described as **scalping,** in which a stubbly, brown appearance occurs on the turf. Visually this adverse mowing stress results in a temporary thinning of the turf, with turf recovery being significantly slowed if the apical meristems in the individual grass shoots are removed. **An even greater negative factor is that the hormonal control within the plant activates carbohydrate partitioning in which the available carbohydrates move to the shoot meristematic area to promote replacement of the green leaves.** Typically in this process the roots will turn brown and essentially die back to the meristematic areas in the crowns and lateral stem nodes. Replacement of this root system may not occur until after significant recovery of the green shoots is achieved, which may be in the order of 2 to 3 weeks duration. During this period the turf is prone to certain environmental stresses, such as drought. In addition, rhizome or stolon growth will cease for the interim period.

Species-Specific Mowing Practices Suggested for Sports Fields, Golf Course Fairways, and High-Quality Lawns. (Irrigated unless otherwise noted)

Turfgrass Name		Cutting Height (hard surface setting)			Mowing Frequency Per Week*
Common	**Scientific**		**inch(es)**	**mm**	
annual bluegrasses	*Poa annua*	0.44–0.75	7/16–3/4	11–19	3–5
bentgrasses	*Agrostis* spp.	0.38–0.63	3/8–5/8	10–16	3–5
bermudagrasses:	*Cynodon* hybrids	0.44–0.63	7/16–5/8	11–16	3–5
not irrigated	*C. dactylon*	0.63–1.0	5/8–1	16–25	1–2
fine-leaf fescues	*Festuca* spp.	0.75–1.0	3/4–1	19–25	1–2
Kentucky bluegrass:	*Poa pratensis*	0.75–1.0	3/4–1	19–25	2–4
not irrigated	*Poa pratensis*	1.0–1.25	1–1 1/4	25–32	1
kikuyugrass	*Pennisetum clandestinum*	0.38–0.63	3/8–5/8	10–16	3–5
perennial ryegrass	*Lolium perenne*	0.5–0.88	1/2–7/8	13–22	2–4
seashore paspalum	*Paspalum vaginatum*	0.44–0.63	7/16–5/8	11–16	2–5
tropical carpetgrass	*Axonopus compressus*	0.5–1.0	1/2–1	13–25	2–3
zoysiagrasses	*Zoysia* spp.	0.5–0.75	1/2–3/4	13–19	2–3

* Frequency interval shortens as the nitrogen (N) or irrigation levels increase.

FEATURE ARTICLE

What We Know About Yellow Tuft

Peter H. Dernoeden

Yellow tuft disease is caused by the downy mildew fungus *Sclerophthora macrospora*. ***Sclerophthora macrospora* attacks virtually all turfgrasses** as well as several major grass crops, including rice, sorghum, and corn. Kentucky bluegrass (*Poa pratensis*) sod can be rendered temporarily unsalable, and a severe infection mars the appearance and the playability of creeping bentgrass (*Agrostis stolonifera*) and/or annual bluegrass (*Poa annua* var. *annua*) putting greens. Infected plants generally are not killed by this obligate parasite, and the disease is primarily a problem on putting greens.

Symptoms. On bentgrass greens and tees, the disease appears as yellow spots of 0.25 to 0.5 in. (6.4–12.7 mm) in diameter. In Kentucky bluegrass, and other wider-bladed grasses, the yellow spots are 1 to 3 in. (25–75 mm) in diameter. Each spot consists of one or two plants that have 20 to 30 or more tillers, giving plants a tufted appearance. **The tufting, or abnormal tiller production, is induced by *S. macrospora,* which causes a shift in the production of a hormone (possibly indoleacetic acid) that regulates tillering.** Roots of infected plants are short and bunchy, and the tufts are easily detached from the turf. **During cool and moist periods in late spring and autumn, plants develop a yellow color, at which time the infected plants are "yellow tufted."** The yellowing is the indirect result of heavy spore production by the fungus. These spores swim (zoospores), which accounts for the fact that the disease is more severe in low-lying areas that puddle. Zoospores are produced in lemon-shaped structures called sporangia. Sporangia develop on leaf surfaces from sub-stomatal cavities below the leaf epidermis. During early morning hours, when leaves are wet, the pearly white sporangia can be seen with a hand lens on the upper and to a lesser extent the lower leaf surfaces of infected plants. During most summer months infected plants appear green and amazingly healthy.

In St. Augustinegrass (*Stenotaphrum secundatum*), the disease is called downy mildew instead of yellow tuft, and the symptoms are different. The disease appears as white, linear streaks that run parallel to the leaf veins. Leaves turn yellow and there may be some browning of leaf tips. Excessive tillering does not occur. The disease is disfiguring and St. Augustinegrass growth may be stunted.

Nature of Disease. Plants infected with *S. macrospora* can persist in excess of two years. The pathogen is a very sophisticated obligate parasite. Obligate parasites only can grow and reproduce in living tissues. As a result, most obligate parasites have evolved to the point where they generally do not directly kill plants. Instead, they debilitate or weaken plants, predisposing them to possible injury or death from other stress factors. *Sclerophthora macrospora* gains entry through meristematic tissue (i.e., stems, buds, or the mesocotyl region of germinating seeds), and except for roots, it spreads systemically throughout the plant. Once infected, the mycelium grows upward between cells (i.e., intercellular spaces) from the buds or stem bases into leaf sheaths and then leaf blades. If plants are allowed to produce seedheads, the fungus can grow upward into the culm, invade the inflorescence, and eventually infect the seed. Hence, yellow tuft can be a seedborne disease. When leaves die, the mycelium may differentiate into large, sexual spores called oospores. The oospores are thick-walled survival structures, which can persist indefinitely in dead leaf tissue. They germinate in low numbers in the presence of water and suitable temperature to produce either a germ tube or an oosporangium. Each oosporangium may contain 50 or more zoospores, and they have the same shape and appearance of asexual sporangia and zoospores. While oospores help to disperse the pathogen, the production of zoospores by asexual sporangia is the primary mechanism by which large numbers of plants become infected. Crabgrass (*Digitaria* spp) is very susceptible to *S. macrospora,* and this weed serves as a major harborage site for the production of zoospores and oospores.

Over time, new shoots escape systemic invasion by the fungus and eventually *S. macrospora*-free tillers replace the original plants. Escape of tillers explains the ephemeral nature of yellow tuft symptoms in older stands. Seedlings are most susceptible to infection by *S. macrospora*, which accounts for the fact that the disease is most commonly observed in the spring following autumn seeding. The disease can recur in older turfs during years marked by excessively wet weather.

Culture. Improving drainage may help to alleviate yellow tuft since the disease is most severe in low-lying areas where water collects. As noted previously, it is in wet environments that the swimming zoospores are able to move easily to uninfected plants.

Yellow tuft can be controlled chemically with either fosetyl aluminum (Aliette Signature®) or metalaxyl (Subdue MAXX®). For unknown reasons, **these fungicides generally perform better when tank mixed with Daconil® (chlorothalonil).** Generally, two or three fungicide applications are required to eradicate the fungus in infected plants. After the application(s) of a fungicide, however, plants can retain their tufted appearance for several weeks. It is only until new tillers replace the older infected shoots that plants resume their normal appearance and growth habit.

Bentgrass Dead Spot...

Continued from page 1

Disease symptoms appear initially as small, reddish-brown spots in turf that are 0.5 to 1.0 in. (13 to 25 mm) in diameter. Spots enlarge to only about 3.0 in. (7.6 cm) in diameter, and have tan tissues in the center and reddish-brown leaves on the outer periphery of larger, active patches. The symptoms at times are similar to those associated with copper spot (*Gloeocercosporia sorghi*), dollar spot (*Sclerotinia homoeocarpa*), *Microdochium* patch (*Microdochium nivale*), black cutworm (*Agrotis ipsilon*) damage, and ball mark injury. No foliar mycelium is evident on turf in the field, however, foliar mycelium will develop in a laboratory humidity chamber. The foliar mycelium is pale-pinkish-white, and may take from three to five days to develop on diseased plants maintained under high humidity.

Bentgrass dead spot appears during warm to hot and dry weather from June to October. The disease, however, may remain active until hard frosts occur in November. **Unlike dollar spot, the spots or patches caused by *O. agrostis* rarely coalesce.** Sometimes depressed spots or "crater pits" develop. Darkly pigmented hyphae, typical of the other *Ophiosphaerella* species that attack turf, are not found on roots. The pathogen, however, has been isolated from leaves, stems and roots of diseased plants. It is unknown where infection first occurs, but observations suggest that the pathogen may attack leaves first. The fungus then appears to move from leaves into stem bases and eventually into stolons and roots. **Numerous black, flask-shaped fruiting bodies called pseudothecia may be found embedded in necrotic leaf and sheath tissues.** The fruiting bodies contain large numbers of needle-shaped spores (i.e., ascospores). When mature, ascospores exude through a pore in the top of the neck of pseudothecia. These spores can be found in large numbers on diseased and nearby healthy leaves. The fruiting bodies often are produced in abundance in late summer, and sometimes can be found embedded in dead tissues throughout the winter months.

According to anecdotal information provided by several golf course superintendents dealing with the disease in 1998, the symptoms were arrested by Daconil® (chlorothalonil), Chipco 26GT® (iprodione), and CL 3336® (thiophanate), but little or no suppression was provided by triazole or strobilurin-based fungicides. These observations were confirmed in fungicide trials conducted by Dr. Henry Wetzel at North Carolina State University in 1999. Control may last for only 7 to 10 days, after which time active symptoms may recur. Water-soluble nitrogen fertilizers should be applied to stimulate growth of surrounding, healthy creeping bentgrass plants. Stolon growth into the dead spots or patches is restrained or inhibited. Some recovery occurs as a result of tillering of adjacent healthy plants, but many dead spots do not fully recover prior to winter. During winter, inactive spots or patches appear whitish-tan. Diseased spots often are void of living tissue, and the underlying bare, sandy soil remains evident in the center of dead areas during the winter and following spring.

Virtually nothing is known regarding the disease or biology of the pathogen. The disease does not appear to be specific to any single creeping bentgrass cultivar. On the affected golf courses surveyed, numerous cultivars and blends were used including G-2, L-93, Crenshaw, Pennlinks, Penncross, Providence, Southshore, and SR 1119. All greens' root zone mixes involved were of high sand content, and the mixes were obtained from different regions and/or distributors. Most clubs affected by the disease are 1 to 3 years old, but greens as old as six years have developed the disease. To date, most injury is associated with greens in open or exposed locations, rather than shaded sites. While the disease appears to be widespread in creeping bentgrass, the distribution and importance of the disease in bermudagrass needs to be assessed.

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Terminology Note

The seasons of the year are frequently used in discussions concerning the timing of various turfgrass cultural practices. This includes winter, spring, summer and autumn. There also are subdivisions used, such as early, mid, and late spring. In this regard, it is important to know the exact calendar dates to which each of these seasonal terms relates. In the northern hemisphere spring is the period from the March equinox of approximately the 21st to the June solstice of approximately the 22nd. Thus, the period from March 21st to April 21st would be early spring, April 21st to May 21st mid-spring, and May 22nd to June 22nd late spring.

Research Summary

Salinity Tolerance of Seven Warm-Season Grasses

There is no doubt that soil salinity is an increasing problem worldwide and that an increasing percentage of the land area devoted to turfgrasses will require salinity-tolerant grass species. The objective in this research was to assess the comparative salinity tolerances of seven warm-season grasses, as well as to identify related salinity tolerance mechanisms. The experiment was conducted in a glasshouse in a solution culture system. The salinity treatments involved a gradual daily increase of 25 m*M* NaCl up to 600 m*M* NaCl. Plant response measurements were taken following a 24-hour equilibrium at each 100 m*M* NaCl increment.

The comparative salinity tolerances of the seven warm-season grass species are summarized in the following table. The most tolerant species is listed at the top, followed in declining order of salinity tolerance for those below. All seven C_4 warm-season grasses are in the subfamily Chloridoideae. The results show a wide range in relative tolerance among the seven grasses, which can be grouped in three levels of high, intermediate, and low degrees of salinity tolerance. The comparative species salinity tolerances were negatively correlated with the leaf sodium (Na^+) and chloride (Cl^-) levels. Cellular salt glands were observed in the leaves of all seven species. The mechanism of salt tolerance appeared to be associated with saline ion exclusion. The root weight and relative root length increased under the saline conditions of this study.

Scientific Name	Common Name
Distichlis spicata var. *stricta*	saltgrass
Sporobolus airoides	alkali sacaton
Cynodon dactylon	dactylon bermudagrass cv. Arizona common
Zoysia japonica	Japanese lawngrass cv. Meyer
Sporobolus cryptandrus	sand dropseed
Bouteloua curtipendula	sideoats grama cv. Haskell
Buchlöe dactyloides	American buffalograss cv. Prairie

Comments. Saltgrass and alkali sacaton were highly tolerant of salinity, whereas American buffalograss and sideoats grama were relatively sensitive to salinity. It would have been interesting if St. Augustinegrass (*Stenotaphrum secundatum*), seashore paspalum (*Paspalum vaginatum*), and weeping alkaligrass (*Puccinellia distans*) had also been included in this study.

Source: Salinity Tolerance Mechanisms of Grasses in the Subfamily Chloridoideae, by K.B. Marcum. *Crop Science,* 39:1153–1160.

JB COMMENTS

Turfgrasses—Stream and Lake Bank Issues

A common recommendation promoted by activists is to eliminate turfgrasses along streambanks and lakefronts, and replace them with trees and shrubs, the premise being that turfgrasses are a major problem in nutrient overloads into the water. Unfortunately this is an ill-founded concept that actually may increase both nutrient loading and soil erosion into the water.

First, in terms of erosion control along streambanks, turfgrasses are far superior to trees in stabilizing soils and minimizing soil erosion. This is because of the unique fine, fibrous root system, which permeates and stabilizes the soil in a manner that trees cannot duplicate. In addition, the dense turfgrass canopy on the surface of the soil has the capability to slow high-velocity over-land water flows to non-erosive velocities. Again, trees have a minimal capability in terms of slowing high-velocity, overland flows of water from adjacent areas. The turf canopy also acts as a sponge to hold a significant amount of water in place for ground water recharge.

Activists tend to counter with a response that clippings from grasses are thrown into the water, thereby adding unwanted nutrients to the water. First, a recent multi-year study on a sandy soil involving several turfed fairways positioned adjacent and parallel to a nearby clear-water trout stream showed normal fertilization practices resulted in no significant phosphorus or nitrogen entering the stream water. **A counter response to the allegation that trees are superior in terms of grass clippings entering the water is that deciduous trees lose their leaves in the autumn and have the potential of adding major amounts of nutrients to stream and lake waters.** In addition, wildlife such as geese and ducks that are viewed as desirable also add a greater quantity of nutrients to the water via their excrement.

To maximize the beneficial aspects of grasses along streambanks, it is best that the turf be mowed at a higher height of 3 to 4 in. (75–100 mm). Also, nutrient fertilization in these areas should be minimal, and used only as needed to achieve a relatively dense surface vegetation and root system, which maximizes the beneficial effects of the grasses in terms of soil erosion control, uptake of nutrients, and degradation of undesirable organic compounds.

Invasive Grub Species...

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http://www.ohioline.ag.ohio-state.edu/hyg-fact/2000/2510.html [Factsheet HYG-2510] for an illustration.)

EC grubs grow rapidly, so that severe damage to turf begins to appear by late summer and continues through the autumn. The large, third-instar grubs continue to feed into November, a full month later than JB grubs, before going deeper in the soil for overwintering. They return to the root zone in March as the ground thaws, sometimes also causing severe damage in spring. Where there is thick sod or heavy snow cover, the grubs may remain in the root zone, feeding even in the winter.

EC tends to be our toughest grub species to control. **Imidacloprid (Merit®) at the high labeled rate (0.4 lb of active ingredient per acre) generally works well if applied preventively during the window of early June to mid-July. Thiamethoxam (Meridian®) reportedly provides good preventive control, comparable to imidacloprid.** Halofenozide (Mach 2®) has not performed as well against the EC as against other grub species. Indeed, there is growing research evidence that EC is relatively insensitive to halofenozide's molt-inducing effects. **Trichlorfon can be used for early preventive control after egg hatch,** but large EC grubs are especially hard to control with insecticides once the damage appears.

ASK DR. BEARD

Q *I have been told that the main time to apply potassium fertilizers is in the autumn. Is this correct?*

A The original research demonstrating the beneficial effects of using high potassium levels was conducted by this author in relation to the enhancement of autumn hardiness to low-temperature kill of cool-season turfgrasses. Subsequent research has demonstrated beneficial aspects of higher potassium levels in enhancing tolerance to a broad range of stresses, such as heat, drought, wear, and cold. Higher potassium levels also have a year-round effect in terms of improved rooting and reduced proneness to a broad range of diseases. **Thus, the strategy of higher potassium levels may apply year-round, especially whenever any of the various environmental stresses occurs in a given climatic region.** Specifically, the strategy is as follows: **Once the soil potassium level is demonstrated to be in the high range based on a chemical soil test, then apply potassium at 75 to 100% of the nitrogen rate being applied.** It should also be noted that excessively high potassium applications can result in a competitive inhibition of nutrient uptake that adversely affects certain plant levels, especially magnesium.

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